Full wwPDB NMR Structure Validation Report (i)

May 28, 2020 – 10:45 pm BST

PDB ID	:	2L0J
Title	:	Solid State NMR structure of the M2 proton channel from Influenza A Virus in hydrated lipid bilayer
Authors	:	Sharma, M.; Yi, M.; Dong, H.; Qin, H.; Peterson, E.; Busath, D.D.; Zhou, H.X.; Cross, T.A.
Deposited on	:	2010-07-08

This is a Full wwPDB NMR Structure Validation Report for a publicly released PDB entry.

We welcome your comments at *validation@mail.wwpdb.org*
A user guide is available at
https://www.wwpdb.org/validation/2017/NMRValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The following versions of software and data (see references (1)) were used in the production of this report:

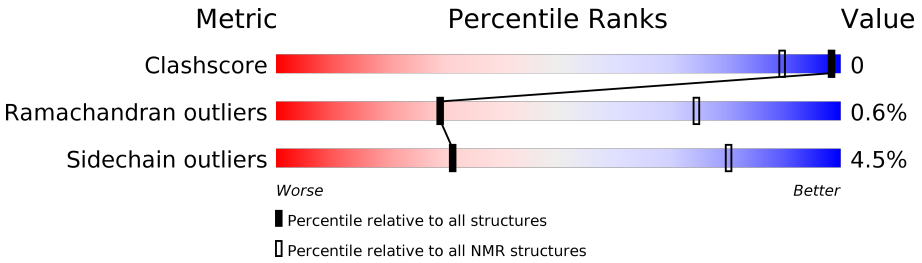
Cyrange	:	Kirchner and Güntert (2011)
NmrClust	:	Kelley et al. (1996)
MolProbity	:	4.02b-467
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
ShiftChecker	:	2.11
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
SOLID-STATE NMR

The overall completeness of chemical shifts assignment was not calculated.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	NMR archive (#Entries)
Clashscore	158937	12864
Ramachandran outliers	154571	11451
Sidechain outliers	154315	11428

The table below summarises the geometric issues observed across the polymeric chains and their fit to the experimental data. The red, orange, yellow and green segments indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria. A cyan segment indicates the fraction of residues that are not part of the well-defined cores, and a grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions <=5%

Mol	Chain	Length	Quality of chain
1	A	44	82% 9% • 7%
1	B	44	82% 11% 7%
1	C	44	82% 11% 7%
1	D	44	82% 11% 7%

2 Ensemble composition and analysis (i)

This entry contains 8 models. Model 6 is the overall representative, medoid model (most similar to other models). The authors have identified model 1 as representative, based on the following criterion: *fewest violations*.

The following residues are included in the computation of the global validation metrics.

Well-defined (core) protein residues			
Well-defined core	**Residue range (total)**	**Backbone RMSD (Å)**	**Medoid model**
1	A:23-A:62, B:22-B:62, C:22-C:62, D:22-D:62 (163)	0.47	6

Ill-defined regions of proteins are excluded from the global statistics.

Ligands and non-protein polymers are included in the analysis.

The models can be grouped into 2 clusters and 2 single-model clusters were found.

Cluster number	Models
1	3, 4, 6
2	1, 2, 8
Single-model clusters	5; 7

3 Entry composition (i)

There is only 1 type of molecule in this entry. The entry contains 2766 atoms, of which 1418 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Matrix protein 2.

Mol	Chain	Residues	Atoms					Trace
			Total	C	H	N	O	
1	A	41	692	228	355	57	52	0
1	B	41	691	228	354	57	52	0
1	C	41	692	228	355	57	52	0
1	D	41	691	228	354	57	52	0

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	19	SER	-	EXPRESSION TAG	UNP P63231
A	20	ASN	-	EXPRESSION TAG	UNP P63231
A	21	ALA	-	EXPRESSION TAG	UNP P63231
A	50	SER	CYS	ENGINEERED MUTATION	UNP P63231
B	19	SER	-	EXPRESSION TAG	UNP P63231
B	20	ASN	-	EXPRESSION TAG	UNP P63231
B	21	ALA	-	EXPRESSION TAG	UNP P63231
B	50	SER	CYS	ENGINEERED MUTATION	UNP P63231
C	19	SER	-	EXPRESSION TAG	UNP P63231
C	20	ASN	-	EXPRESSION TAG	UNP P63231
C	21	ALA	-	EXPRESSION TAG	UNP P63231
C	50	SER	CYS	ENGINEERED MUTATION	UNP P63231
D	19	SER	-	EXPRESSION TAG	UNP P63231
D	20	ASN	-	EXPRESSION TAG	UNP P63231
D	21	ALA	-	EXPRESSION TAG	UNP P63231
D	50	SER	CYS	ENGINEERED MUTATION	UNP P63231

4 Residue-property plots (i)

4.1 Average score per residue in the NMR ensemble

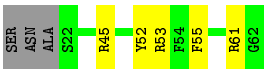
These plots are provided for all protein, RNA and DNA chains in the entry. The first graphic is the same as shown in the summary in section 1 of this report. The second graphic shows the sequence where residues are colour-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. Stretches of 2 or more consecutive residues without any outliers are shown as green connectors. Residues which are classified as ill-defined in the NMR ensemble, are shown in cyan with an underline colour-coded according to the previous scheme. Residues which were present in the experimental sample, but not modelled in the final structure are shown in grey.

- Molecule 1: Matrix protein 2

Chain A:

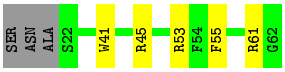
- Molecule 1: Matrix protein 2

Chain B:



- Molecule 1: Matrix protein 2

Chain C:



- Molecule 1: Matrix protein 2

Chain D:

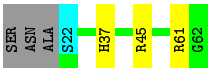
4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

4.2.1 Score per residue for model 1

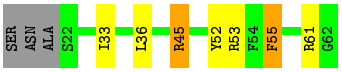
- Molecule 1: Matrix protein 2

Chain A:



- Molecule 1: Matrix protein 2

Chain B:

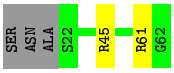


- Molecule 1: Matrix protein 2

Chain C:

- Molecule 1: Matrix protein 2

Chain D:



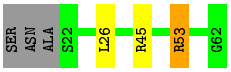
4.2.2 Score per residue for model 2

- Molecule 1: Matrix protein 2

Chain A:

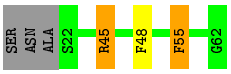
- Molecule 1: Matrix protein 2

Chain B:



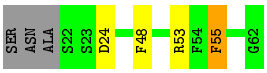
- Molecule 1: Matrix protein 2

Chain C:



- Molecule 1: Matrix protein 2

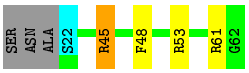
Chain D:



4.2.3 Score per residue for model 3

- Molecule 1: Matrix protein 2

Chain A:

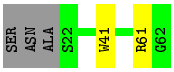


- Molecule 1: Matrix protein 2

Chain B:

- Molecule 1: Matrix protein 2

Chain C:



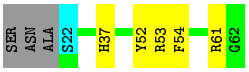
- Molecule 1: Matrix protein 2

Chain D:

4.2.4 Score per residue for model 4

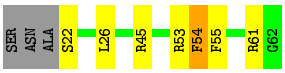
- Molecule 1: Matrix protein 2

Chain A:



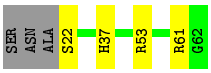
- Molecule 1: Matrix protein 2

Chain B:



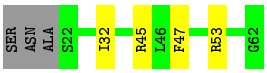
- Molecule 1: Matrix protein 2

Chain C:



- Molecule 1: Matrix protein 2

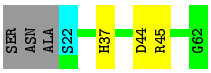
Chain D:



4.2.5 Score per residue for model 5

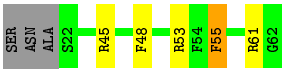
- Molecule 1: Matrix protein 2

Chain A:



- Molecule 1: Matrix protein 2

Chain B:

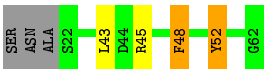


- Molecule 1: Matrix protein 2

Chain C:

- Molecule 1: Matrix protein 2

Chain D:



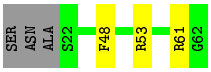
4.2.6 Score per residue for model 6 (medoid)

- Molecule 1: Matrix protein 2

Chain A:

- Molecule 1: Matrix protein 2

Chain B:

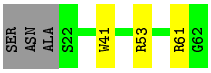


- Molecule 1: Matrix protein 2

Chain C:

- Molecule 1: Matrix protein 2

Chain D:



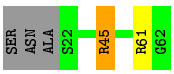
4.2.7 Score per residue for model 7

- Molecule 1: Matrix protein 2

Chain A:

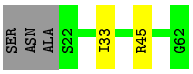
- Molecule 1: Matrix protein 2

Chain B:



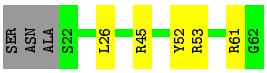
- Molecule 1: Matrix protein 2

Chain C:



- Molecule 1: Matrix protein 2

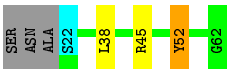
Chain D:



4.2.8 Score per residue for model 8

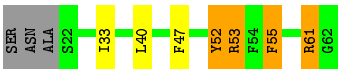
- Molecule 1: Matrix protein 2

Chain A:



- Molecule 1: Matrix protein 2

Chain B:



- Molecule 1: Matrix protein 2

Chain C:

- Molecule 1: Matrix protein 2

Chain D:

5 Refinement protocol and experimental data overview (i)

The models were refined using the following method: *simulated annealing and molecular dynamics, molecular dynamics.*

Of the 8 calculated structures, 8 were deposited, based on the following criterion: *structures with the least restraint violations.*

The following table shows the software used for structure solution, optimisation and refinement.

Software name	Classification	Version
X-PLOR NIH	refinement	2.23
X-PLOR NIH	structure solution	2.23
NAMD	refinement	2.7b

No chemical shift data was provided. Note: This is a solid-state NMR structure, where hydrogen atoms are typically not assigned a chemical shift value, which may lead to lower completeness of assignment measure.

No validations of the models with respect to experimental NMR restraints is performed at this time.

COVALENT-GEOMETRY INFOmissingINFO

5.1 Too-close contacts (i)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in each chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes averaged over the ensemble.

Mol	Chain	Non-H	H(model)	H(added)	Clashes
1	A	331	351	350	0±0
1	B	337	354	354	0±0
1	C	337	355	354	0±1
1	D	337	354	354	0±0
All	All	10736	11312	11296	5

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 0.

All unique clashes are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:38:LEU:HD22	1:D:33:ILE:HG23	0.55	1.78	8	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:C:41:TRP:CD1	1:C:42:ILE:HG13	0.50	2.41	8	1
1:A:41:TRP:CZ2	1:A:45:ARG:NH1	0.46	2.84	2	1
1:C:41:TRP:CD1	1:C:42:ILE:N	0.46	2.84	8	1
1:B:33:ILE:HG21	1:C:38:LEU:CD2	0.45	2.41	8	1

5.2 Torsion angles (i)

5.2.1 Protein backbone (i)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all PDB entries followed by that with respect to all NMR entries. The Analysed column shows the number of residues for which the backbone conformation was analysed and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	39/44 (89%)	37±1 (96±2%)	2±1 (4±2%)	0±0 (0±0%)	100	100
1	B	39/44 (89%)	37±1 (95±1%)	2±1 (4±2%)	0±0 (1±1%)	20	68
1	C	39/44 (89%)	36±1 (93±2%)	3±1 (7±3%)	0±0 (0±1%)	44	80
1	D	39/44 (89%)	37±1 (95±2%)	1±1 (4±3%)	1±1 (1±1%)	16	63
All	All	1248/1408 (89%)	1180 (95%)	60 (5%)	8 (1%)	29	74

All 4 unique Ramachandran outliers are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type	Models (Total)
1	B	48	PHE	3
1	D	48	PHE	3
1	D	32	ILE	1
1	C	48	PHE	1

5.2.2 Protein sidechains (i)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all PDB entries followed by that with respect to all NMR entries. The Analysed column shows the number of residues for which the sidechain conformation was analysed and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	35/38 (92%)	34±0 (96±1%)	1±0 (4±1%)	36	84
1	B	36/38 (95%)	34±2 (93±5%)	2±2 (7±5%)	20	69
1	C	36/38 (95%)	34±1 (95±2%)	2±1 (5±2%)	31	80
1	D	36/38 (95%)	35±1 (97±2%)	1±1 (3±2%)	46	90
All	All	1144/1216 (94%)	1093 (96%)	51 (4%)	31	80

All 33 unique residues with a non-rotameric sidechain are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type	Models (Total)
1	A	37	HIS	5
1	B	55	PHE	4
1	C	41	TRP	3
1	D	52	TYR	3
1	B	36	LEU	2
1	C	37	HIS	2
1	B	52	TYR	2
1	C	55	PHE	2
1	C	26	LEU	2
1	B	26	LEU	2
1	B	45	ARG	2
1	B	49	LYS	1
1	D	26	LEU	1
1	B	40	LEU	1
1	B	47	PHE	1
1	D	55	PHE	1
1	C	22	SER	1
1	D	24	ASP	1
1	A	52	TYR	1
1	C	51	ILE	1
1	B	33	ILE	1
1	C	33	ILE	1
1	D	43	LEU	1
1	B	61	ARG	1
1	A	48	PHE	1
1	D	41	TRP	1
1	B	54	PHE	1
1	B	51	ILE	1
1	A	47	PHE	1
1	C	47	PHE	1
1	A	38	LEU	1
1	A	44	ASP	1

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Mol	Chain	Res	Type	Models (Total)
1	A	51	ILE	1

5.2.3 RNA (i)

There are no RNA molecules in this entry.

5.3 Non-standard residues in protein, DNA, RNA chains (i)

There are no non-standard protein/DNA/RNA residues in this entry.

5.4 Carbohydrates (i)

There are no carbohydrates in this entry.

5.5 Ligand geometry (i)

There are no ligands in this entry.

5.6 Other polymers (i)

There are no such molecules in this entry.

5.7 Polymer linkage issues (i)

There are no chain breaks in this entry.

6 Chemical shift validation (i)

No chemical shift data were provided